

WHAT IS CLAIMED IS:

1. ~~A method for measuring the amount which an object to be measured has moved in a plane and back-and-forth using a granular speck pattern generated by a reflecting laser beam in non-contact fashion comprising steps of:~~

irradiating an object to be measured with a laser beam;

5 optically and directly picking up the granular speck pattern generated by the reflecting laser beam as an index;

calculating the amount of movement on the basis of movement of the granular speck pattern with respect to said index; and

10 displaying a result of the calculation as a numerical value of the measured amount of movement.

2. An apparatus for measuring the amount which an object to be measured has moved in a plane and back and forth using a granular speck pattern generated by a reflecting laser beam, said apparatus comprising:

5 a laser projector to generate a granular speck pattern corresponding to a rough surface of an object to be measured;

a line sensor to directly pick up said granular speck pattern as an index;

an A/D converter coupled to said line sensor to convert an analog signal supplied from said line sensor to a digital signal;

10 a processing unit coupled to the A/D converter to calculate the amount of movement of said object on the basis of movement of the granular speck in said pattern with respect to a pixel interval of said granular speck pattern picked up by said line sensor and represented by said A/D converted signal; and

a display coupled to said processing unit to display the amount of movement calculated by said processing unit.

3. The apparatus as defined in claim 2 and further including a light shield position in front of said line sensor.

4. The apparatus as defined in claim 3 wherein said line sensor comprises a tube.

5. The apparatus as defined in claim 4 wherein said tube is cylindrical.

6. ~~An apparatus for measuring the amount which an object to be measured has moved in a plane and back and forth using a granular speck pattern generated by a reflecting laser beam, said apparatus comprising:~~

5 a laser projector for generating a granular speck pattern corresponding to the surface of an object to be measured;

a line sensor positioned to detect said granular speck pattern as an index; and

an electrical circuit coupled to said line sensor for calculating the amount of movement of said object on the basis of movement of the granular speck in said pattern with respect to a pixel interval of said granular speck pattern picked up by said line sensor and displaying the amount of movement calculated by said processing unit.

7. A method for measuring the amount which an object to be measured has moved by detecting a granular speck pattern reflected by a laser beam comprising steps of:

irradiating an object to be measured with a laser beam;

detecting a granular speck pattern generated by the reflecting laser beam as an index;

5 calculating the amount of movement on the basis of movement of the granular speck pattern with respect to said index; and

displaying a result of the calculation as a numerical value of the measured amount of movement.

8. An apparatus for measuring the amount which an object to be measured has moved using a granular speck pattern generated by a reflecting laser beam, said apparatus comprising:

a laser source for generating a granular speck pattern corresponding to a rough surface of an object to be measured;

5 a line sensor positioned to detect said granular speck pattern as an index;

~~a processing unit coupled to said line sensor to calculate the amount of movement of said object on the basis of movement of a granular speck in said granular speck pattern with respect to a pixel interval of said granular speck pattern detected by said line sensor; and~~
~~a display coupled to said processing unit to display the amount of movement calculated~~
10 by said processing unit.

9. The apparatus as defined in claim 8 and further including a light shield position in front of said line sensor.

10. The apparatus as defined in claim 9 wherein said line sensor comprises a tube.

11. The apparatus as defined in claim 10 wherein said tube is cylindrical.

12. The apparatus as defined in claim 8 and further including an A/D converter coupled to said line sensor to convert an analog signal supplied from said line sensor to a digital signal.

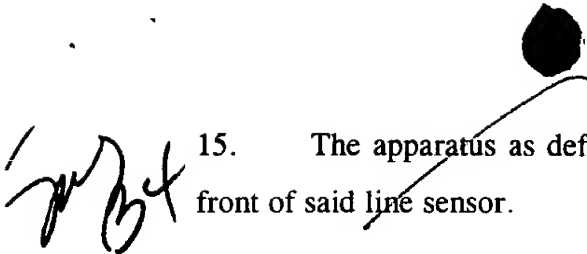
13. ~~An apparatus for measuring the amount which an object to be measured has moved in a plane and back and forth using a granular speck pattern generated by a reflecting laser beam, said apparatus comprising:~~

~~a collimated light source for generating a granular speck pattern corresponding to the surface of an object to be measured;~~

~~a line sensor positioned to detect said granular speck pattern as an index; and~~

~~an electrical circuit coupled to said line sensor for calculating the amount of movement of said object on the basis of movement of the granular speck in said pattern with respect to a pixel interval of said granular speck pattern picked up by said line sensor and displaying the amount of movement calculated by said processing unit.~~

14. The apparatus as defined in claim 13 wherein said collimated light source is a laser.

15. The apparatus as defined in claim 14 and further including a light shield position in front of said line sensor.

16. The apparatus as defined in claim 15 wherein said line sensor comprises a tube.

17. The apparatus as defined in claim 16 wherein said tube is cylindrical.

2025 RELEASE UNDER E.O. 14176